# QUALITY ASSURANCE PROJECT PLAN

**For the**
**Residential Study Area**
**near the**
**Former Celotex Site**
**2800 South Sacramento Avenue**
**Chicago, Illinois 60623**

Prepared for

## Honeywell International Inc.

April 2006

Prepared by

CH2MHILL

# QUALITY ASSURANCE PROJECT PLAN

## RESIDENTIAL STUDY AREA NEAR THE FORMER CELOTEX SITE
**Chicago, Illinois**

**Honeywell International Inc.**

Prepared by: CH2M HILL

Date: April 2006

Approved by:

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Rosita Clarke-Moreno

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CH2M HILL Project Manager
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CH2M HILL Quality Assurance Manager

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Laboratory Operations Manager

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Quality Assurance Officer

# Distribution List

Rosita Clarke-Moreno, USEPA, Region 5, Remedial Project Manager
USEPA, Region 5, Quality Assurance Reviewer
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CH2M HILL Quality Assurance Manager
Laboratory Operations Manager
Laboratory Quality Assurance Officer

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# Acronyms and Abbreviations

| | |
|---|---|
| B(a)P EQ | benzo(a)pyrene equivalents |
| C | Celsius |
| CCC | calibration check compounds |
| CCV | calibration check verification |
| CD-ROM | compact disk - read only memory |
| CLP | Contract Laboratory Program |
| COC | chain-of-custody |
| DFTPP | decafluorotriphenylphosphine |
| DMP | Data Management Plan |
| DMS | data management system |
| DQO | data quality objective |
| DVD | digital video disk |
| EB | equipment blank |
| EDD | electronic data deliverable |
| EICP | extracted ion current profile |
| FB | field blank |
| FSP | field sampling plan |
| FTL | field team leader |
| GC/MS | gas chromatography/mass spectrometry |
| ID | identification number |
| L | liter |
| LCL | lower control limit |
| LCS | laboratory control sample |
| LIMS | laboratory information management system |
| MDL | method detection limit |
| µg/L | micrograms per liter |
| mg/L | milligrams per liter |
| MS/MSD | matrix spike/matrix spike duplicate |
| PAH | polynuclear aromatic hydrocarbons |
| PPM | parts per million |
| QAM | quality assurance manager |
| QAPP | Quality Assurance Project Plan |
| QA/QC | quality assurance/quality control |

| | |
|---|---|
| R | recovery |
| RL | reporting limits |
| RF | response factor |
| RPD | relative percent difference |
| RPM | Remedial Project Manager |
| RRF | relative response factor |
| RSD | relative standard deviation |
| SM | site manager |
| SOP | standard operating procedure |
| SPCC | system performance check compounds |
| UCL | upper control limit |
| USEPA | United States Environmental Protection Agency |
| VOA | volatile organic analysis |

SECTION 1

# Project Management

## 1.1 Introduction

The United States Environmental Protection Agency (USEPA) requires parties conducting environmental monitoring and measurement efforts mandated or supported by USEPA to participate in a centrally managed Quality Assurance Project Plan (QAPP). Parties generating data under this program must implement procedures so that the precision, accuracy, representativeness, completeness, and comparability of their data are known and documented. To meet this objective, a written QAPP must be prepared covering each project to be performed All project participants, including subcontractors, must follow the procedures and protocols outlined in the QAPP.

This QAPP presents the organization, objectives, functional activities, and specific quality assurance (QA) and quality control (QC) activities for the residential soil sampling investigation near the former Celotex site in Chicago, Illinois.

This section provides an overall approach for managing the project that includes the following:

- Project organization, roles, and responsibilities
- Problem definition and background information
- Project description and schedule
- Data quality objectives (DQOs) and criteria for measurement data
- Instructions for special training requirements/certification
- Instructions for documentation and records management

## 1.2 Project Organization

CH2M HILL is responsible for all phases of the residential soil sampling investigation near the former Celotex site The QA and management responsibilities of key project personnel are defined below and shown in Figure 1.

### 1.2.1 USEPA Region 5, Remedial Project Manager

The USEPA's remedial project manager (RPM) is responsible for the review of the project plans, including this QAPP, the project data, and results. Ms. Rosita Clarke-Moreno is the RPM for the former Celotex site in Chicago, Illinois.

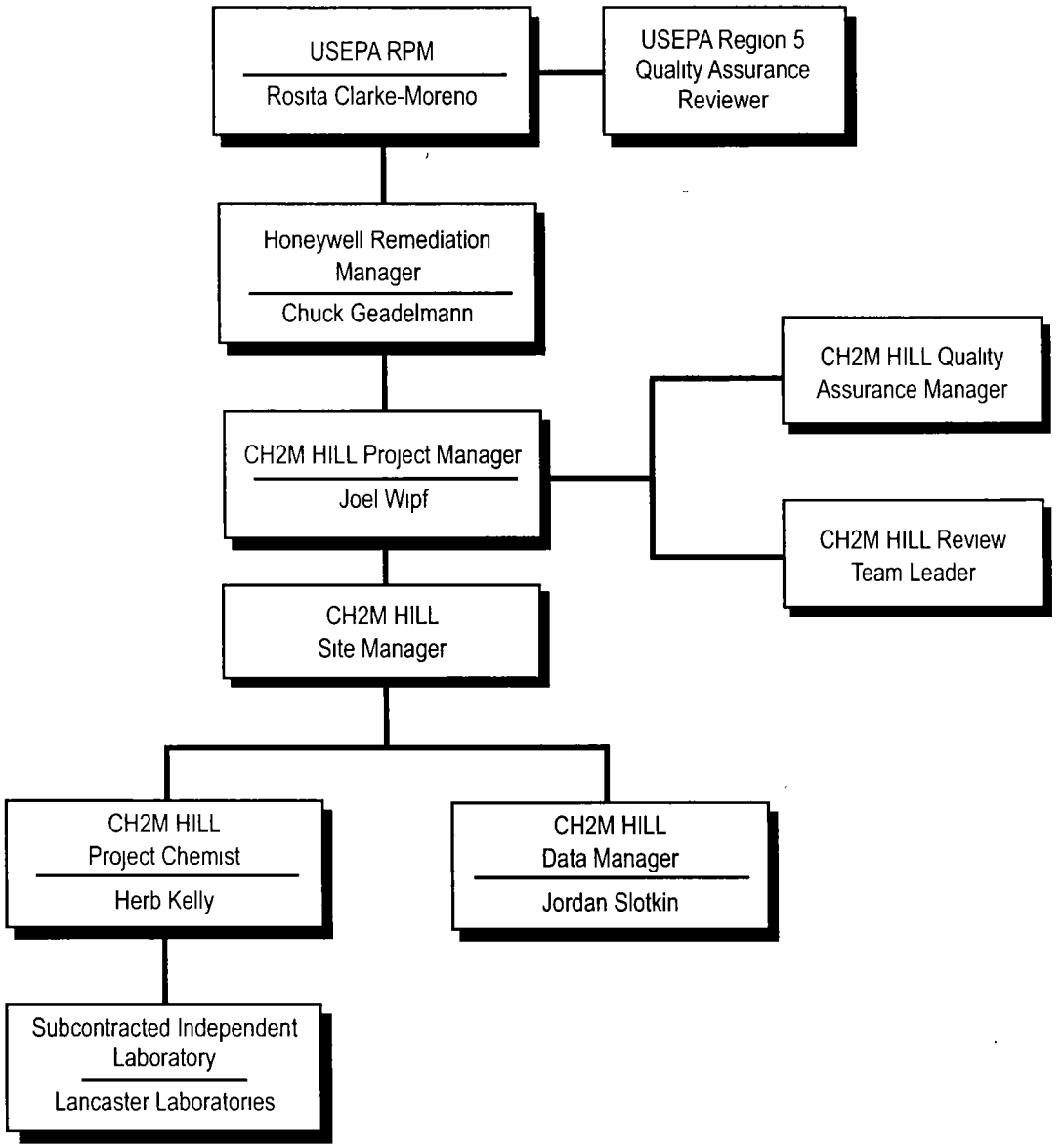



Figure 1
**Project Organization Chart**
**Former Celotex Site**
*Chicago, Illinois*

### 1.2.2 USEPA Region 5, Quality Assurance Reviewer

The USEPA representative is responsible for reviewing and approving this QAPP.

### 1.2.3 Honeywell Remediation Manager

Mr Chuck Geadelmann is Honeywell's remediation manager

### 1.2.4 CH2M HILL Project Manager

Joel Wipf, CH2M HILL's project manager, has overall responsibility for meeting Honeywell's objectives and CH2M HILL's quality standards, as well as technical QC and project oversight.

### 1.2.5 CH2M HILL Quality Assurance Manager

The quality assurance manager (QAM) will remain independent of direct job involvement and day-to-day operations, but has not been identified at this time The QAM has the following responsibilities:

- Directing the QA review of the various phases of the project, as necessary
- Directing the review of QA plans and procedures
- Providing QA technical assistance to project staff, as necessary

The QAM also has direct access to management staff to resolve QA disputes, as necessary.

### 1.2.6 CH2M HILL Site Manager

The site manager (SM) is responsible for implementing the project and achieving the technical, financial, and scheduling objectives of the project. As such, the SM is authorized to commit the resources necessary to meet project objectives and requirements. The SM will report directly to the CH2M HILL Project Manager and will be the major point of contact for matters concerning the project. The SM has not been identified at this time. The SM has the following responsibilities:

- Defining project objectives and developing a detailed work plan and schedule
- Establishing project policy and procedures to address the specific needs of the project as a whole, as well as the particular objectives of each task
- Acquiring and applying technical and corporate resources to meet budget and schedule constraints
- Orienting field leaders and support staff to the project's special considerations
- Monitoring and directing other team members
- Developing and meeting ongoing project or task staffing requirements, including mechanisms for reviewing and evaluating each task product
- Reviewing the work performed on each task to ensure quality, responsiveness, and timeliness

- Reviewing and analyzing overall task performance with regard to the planned schedule and budget
- Representing the project team at meetings and public hearings

### 1.2.7 CH2M HILL Review Team Leader

The review team leader (RTL) supports the SM in site management activities and coordinates CH2M HILL internal reviews. The RTL has not been identified at this time. The RTL will be involved in ongoing planning work.

### 1.2.8 CH2M HILL Project Data Manager

Jordan Slotkin, CH2M HILL's project data manager, is responsible for tracking data and overseeing the data base and data management functions. His specific responsibilities include the following:

- Establishing the Data Management System (DMS)
- Overseeing the data management process including data conversion/manual entry
- Performing QC review of entered data
- Preparing required tables and specific queries/reports

### 1.2.9 CH2M HILL Project Chemist

Herb Kelly, CH2M HILL's project chemist, is responsible for tracking data and overseeing the data evaluation. His specific responsibilities include the following:

- Scheduling the analytical laboratories
- Coordinating activities with laboratories and data validators
- Overseeing data validation and the production of results tables
- Ensuring the implementation and follow-up on corrective actions
- Evaluating data usability
- Overseeing the tracking of samples and data from the time of field collection until results are entered into the DMS

## 1.3 Problem Definition/Background Information

USEPA has defined the residential area requiring sampling as within the boundary set by Whipple Avenue, Sacramento Avenue, 28th Street, and 26th Street In addition, Honeywell has voluntarily agreed to perform sampling within a larger area, although no connection has been made between these areas and the site to date. The residential properties proposed to be sampled within this work plan are bounded by 26th Street to the north, Kedzie Avenue to the west, 31st Street to the south, and Sacramento Avenue to the east. This area is referred to as the "residential study area."

Three residential sampling events were conducted between 1995 and 1999 under USEPA-approved work plans. Surface soil samples were collected from a subset of the residential properties surrounding the site during these events The objectives were to obtain data to support risk assessment and background evaluations Elevated levels of polynuclear aromatic hydrocarbons (PAHs) were documented within some of the residential soils. However, additional soil sampling is necessary to further define the area of impact in support of removal action planning.

Further detailed information is contained in Sections 1 and 2 of the Work Plan, including the site location map as Figure 1-1 and an aerial photograph as Figure 1-2. Work Plan Figures 1-1 and 1-2 are included as Appendix C of this QAPP.

## 1.4 Site History

The former Celotex site was used for making, storing, and selling asphalt roofing products Former operations at the 24-acre main site during the approximate period of 1911 to 1989 resulted in the release of PAHs in the air. It is possible that PAH compounds may have migrated through airborne dispersion beyond the Celotex site boundaries and may be present in surface soils in some residential areas surrounding the site. Facility closure and demolition of the main site and subsequent actions have removed the previous source area such that no ongoing releases from the site exist.

The Celotex site formerly housed several manufacturing-related buildings including a large warehouse, smaller storage sheds, an enclosed tank area, and an office building. All buildings and former facility features have been demolished and a soil cover was placed subsequent to demolition. The main site is currently surrounded by a chain-link fence with a single entrance located at the main gate on Sacramento Avenue. In 2002, Sacramento Corporation bought the 22-acre portion of the Celotex property and placed approximately 2 feet of gravel on the main site for parking trucks.

## 1.5 Project Description and Schedule

### 1.5.1 Project Description

The objective of the residential soil sampling investigation is to further define the extent of PAH impacts within surface soil and shallow subsurface soil at residential properties surrounding the site, characterize residential properties on a lot-specific and depth-specific basis to support removal action planning based on benzo(a)pyrene (BAP) equivalent concentrations, and to assist in decision-making for the residential study area.

Previous investigations determined that PAH compounds are present. The analytical objectives of the proposed soil sampling are to collect data within the residential areas surrounding the site of sufficient quality for evaluation to support future decision-making and removal action planning.

### 1.5.2 Project Schedule

CH2M HILL has proposed to begin sampling on July 10, 2006. The sampling will take place during the work week (Monday to Friday) utilizing two field teams, with sampling scheduled to be completed by mid-August 2006. This will include collection of composite surface soil samples and subsurface soil samples The analytical results will be provided on a 7-day turnaround basis with the data packages to be received in 21 days from time of sample receipt at the laboratory. Section 2 of this document describes the sampling analyses in detail. Appendix D contains the project schedule as described in the project Work Plan. (CH2M HILL, 2006)

## 1.6 Data Quality Objectives and Criteria for Measurement Data

### 1.6.1 Data Quality Objectives

DQOs are qualitative and quantitative statements that specify the quality of data required for supporting decisions made during or after site-related activities. Project-specific DQOs are developed using the seven step process presented below (DQOs presented in Table 1):

1. **State the problem.** Describe the problem to be studied concisely.
2. **Identify the decisions.** State the decisions to be made to solve the problem
3. **Identify inputs to the decisions.** Identify information and supporting measurements needed to make the decisions and describe the source(s) of the information.
4. **Define the boundaries of the study.** Specify conditions (that is, time periods and spatial locations).
5. **Develop a decision rule.** Define the conditions by which a decision-maker will select alternatives, usually specified as "if/then" statements (for example, if average concentration in soil is less than cleanup level, then the site achieves remedial action goals).
6. **Specify tolerable limits on decision errors.** Define in statistical terms.
7. **Optimize the design for obtaining data.** Evaluate the results of the previous steps and develop the most resource-efficient design for data collection.

**TABLE 1**
Honeywell Celotex Data Quality Objectives
*Honeywell Former Celotex Site, Chicago, Illinois*

| Task | Step 1: Statement of Problem | Step 2 Identify the Decision | Step 3: Inputs to Decisions | Step 4: Study Boundaries | Step 5: Decision Rules | Step 6: Limits of Decision Errors | Step 7 Optimize the Sampling Design |
|---|---|---|---|---|---|---|---|
| **Residential Surface and Subsurface Soil Sampling** | Data gathered from three phases of residential soil sampling in neighborhoods adjacent to the Celotex Facility has demonstrated the presence of PAHs<br><br>Human health risk assessments indicate that levels of some PAHs in the soil may pose an unacceptable risk to the public<br><br>The USEPA has established a cleanup objective of 10 parts per million (ppm) B(a)P EQ While this level may not be the only criteria applied to guide remedial action planning, the additional sampling is intended to determine what the B(a)P EQ concentrations are in soil at each residential property within the study area to support remedial action planning | Does the B(a)P EQ PAH concentration in soil exceed the cleanup objectives at residences that have been sampled?<br><br>If so, where are these residences located and is soil to be removed at these locations? | Surface and shallow subsurface soil samples are to be collected from three depth intervals for each residence at five consistently chosen locations Samples will be collected from 0-6 inches, 1-2 feet and 2-3 feet to evaluate vertical distribution Soil from each discrete interval will be composited across the five sampling locations from which an aliquot of soil will be submitted for analysis<br><br>The concentrations of PAHs will be determined from which the B(a)P EQ concentration will be calculated The B(a)P EQ will be compared with cleanup objectives to determine the need for remedial actions | The residential study area is within the boundary set by 26th Street to the north, Kedzie Avenue to the west, 31st Street to the south, and Sacramento Avenue to the east<br><br>Soil samples will be collected from discrete intervals (see "Inputs to Decisions") and analyzed for the following PAHs indeno(1,2,3-cd)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, benzo(a)pyrene, dibenz(a,h) anthracene, and benzo(a)anthracene<br><br>Potential constraints or obstacles for implementing the SAP may include the following<br>• Unsafe conditions<br>• Weather (lighting, snow, ice, extreme temperatures)<br>• Access to properties | Two levels of decision rules will determine the need for further work The first decision rule addresses the quality of the data used as input to the second decision rule Individual analytical results will undergo an evaluation process to address usability Precision, Accuracy, Representativeness, Completeness, and Comparability parameters will be assessed as they relate to QC Level III and Level IV data packages If an unacceptable percentage of analytical results are deemed unusable or rejected, resampling will be necessary<br><br>Data that are considered valid and usable will be used to determine a B(a)P EQ concentration for each discrete depth interval at each property sampled<br><br>The decision rule to move forward and identify properties for remediation is currently being formulated among the stake holders (e g , USEPA, the respondents) | Decision errors are those made when a site manager chooses the wrong response action, but would have chosen another response if given perfect data Contributing to this error are sampling design errors and measurement errors<br><br>Sampling design errors will be minimized by implementing a standard design approach at each property A standardized, biased sampling approach will be implemented where obtaining undisturbed soils from areas unaffected by obvious anthropogenic disturbances (surface spills, proximity to asphalt covers, coal bins, etc ) will be the goal Spatial variability will be minimized by compositing samples over discrete depth intervals across the property<br><br>Measurement errors will be controlled by implementing rigorous laboratory quality control/quality assurance procedures that will be evaluated through strict adherence with this QAPP and established USEPA guidelines | Five samples per residential property were determined to be adequate to evaluate the depth-specific B(a)P EQ concentrations Sample design was adapted from the USEPA's "Superfund Lead-Contaminated Residential Sites Handbook," accounting for the smaller size, exposed soil area, and variability of the residential lots present |

### 1.6.2 Measurement Performance Criteria

The measurement performance criteria will be checked on several levels using the following methods:

- Built-in QC standards
- Senior review
- Management controls

The measurement data must abide by specific QC standards. Data that do not meet these standards are qualified accordingly. The analytical data and the QC results will be checked by the bench chemist, the laboratory's QAM, and CH2M HILL's project chemist.

CH2M HILL staff members with relevant technical experience will review all documents that pertain to the project's quality standards. The field team leader (FTL) will supervise activities to assess whether field operating procedures are being followed during field sampling activities. Section 3 describes specific QC checks and corrective action measures.

## 1.7 Instructions for Special Training Requirements/Certification

As noted in Subsection 1.2, Project Organization, project team members with the necessary experience and technical skills were chosen to perform required project tasks.

The independent subcontractor selected to perform laboratory analyses will meet the project-specific requirements and USEPA specifications.

## 1.8 Instructions for Documentation and Records

### 1.8.1 Field Sampling Documentation

Field sampling activities will be recorded in field logbooks and property worksheets. Field logbook and property worksheet entries will include descriptions with as much detail as possible so that those going to the site do not have to recall a particular situation from memory. Modifications to field sampling protocols must be documented in the field logbook. The FTL is responsible for ensuring that modifications to sampling protocols are also documented.

The field logbooks to be used will be bound field survey books or notebooks The property worksheets will be separate sheets to go out with the field crews, but will be copied and stored in a 3-ring binder in a secure location when not in use. Logbooks will be assigned to the field crew, but stored in a secure location when not in use. Project-specific document numbers will identify each logbook, the title page of which will contain the following information

- Name of the person to whom the logbook is assigned
- Logbook number
- Project name
- Project start date
- Project end date

At the beginning of each entry, the date, start time, weather, names of all sampling team members present, and the signature of the person making the entry will be documented. Measurements and samples collected will be recorded with a detailed description of the location of the station. The number of all photographs taken will also be noted. Equipment used to make measurements will be identified, along with the date of calibration.

The property worksheets will include the date, names of field crew members, address of the property, sample location name, and sample collection time The bottom half of the property worksheet will have space to map the 5 point composite sample collection points in relation to property markers and for survey coordinates.

All entries will be made in ink with no erasures allowed If an incorrect entry is made, the information will be crossed out with a single strike mark and initialed. Blank pages will be noted as being intentionally left blank

Samples will be collected following the sampling procedures documented in the Field Sampling Plan (FSP). Sample collection equipment will be identified, along with the time of sampling, sample description, parameters being analyzed, and number of containers used. Unique sample identification numbers (IDs) will be assigned to each sample as described in the FSP. Field duplicate samples, which will receive a unique sample ID, will be noted in the field logbook.

Field personnel will provide comprehensive documentation of all aspects of field sampling, field analysis, and sample chain of custody (COC). This documentation constitutes a record that allows for the reconstruction of all field events to aid in the data review and interpretation process. All documents, records, and information relating to the performance of the field work will be retained in the project file

### 1.8.2 Data Reporting

For the purposes of this investigation, two data reporting levels have been defined and summarized in Table 2:

- **Level 3—Analytical Reporting**. Full contract laboratory program (CLP)-equivalent forms reporting is required for all non-field data.
- **Level 4—Analytical Reporting**. Full CLP equivalent reporting, including all raw data, is required for 50 percent of all non-field data sent to the subcontracted laboratory.

TABLE 2
Data Package Deliverables
*Honeywell Former Celotex Site, Chicago, Illinois*

| All Analytical Fractions | |
|---|---|
| Case Narrative—A detailed case narrative per analytical fraction is required and will include explanation of any non-compliance and/or exceptions and corrective action Exceptions will be noted for receipt, holding times, methods, preparation, calibration, blanks, spikes, surrogates (if applicable), and sample exceptions | • |
| Sample ID Cross Reference Sheet (Lab IDs and Client IDs) | • |
| Completed COC forms and any sample receipt information | • |
| Sample preparation logs (extraction/digestion) | • |
| Copies of non-conformance memos and corrective actions | • |

| Form [a] | Gas Chromatography/Mass Spectrometry (GC/MS) Organic Fractions | Level III | Level IV |
|---|---|---|---|
| 1 | Sample results | • | • + raw |
| 2 | Surrogate Recovery Summary (w/applicable control limits) | • | • |
| 3 | Matrix Spike (MS)/Matrix Spike Duplicate (MSD) Accuracy and Precision Summary[b] | • | • + raw |
| 3 | Laboratory Control Sample (LCS) Accuracy Summary | • | • + raw |
| 4 | Method Blank Summary | • | • + raw |
| 5 | Instrument Tuning Summary (including tuning summary for applicable initial calibrations) | • | • |
| 6 | Initial Calibration Summary (including concentration levels of standards) | • | • + raw |
| 7 | Continuing Calibration Summary | • | • + raw |
| 8 | Internal Standard Summary (including applicable initial calibrations) | • | • |

[a]CLP form or summary form with equivalent information
[b]Relative percent difference (RPD) calculated according to method specifications (CLP using percent recovery, SW-846 using concentration)

### 1.8.2.1 Field Data Reporting

Information collected in the field through visual observation, manual measurement, and field instrumentation will be recorded in field notebooks and/or property worksheets and then entered into an electronic data log. The FTL or project chemist will review the data for adherence to this QAPP and consistency Any concerns identified as a result of this review will be discussed with the QAM, corrected if possible, and incorporated into the data evaluation process.

Field data calculations, transfers, and interpretations will be conducted by the field crew and reviewed for accuracy by the FTL or project chemist. The appropriate task manager will review field documentation, data reduction, and accuracy of data entries into the data log. The data logs and documents will be checked for the following:

- General completeness
- Readability
- Use of appropriate procedures
- Modifications to sampling procedures are clearly stated
- Appropriate instrument calibration and maintenance records
- Reasonability of data collected
- Accuracy of sample locations
- Accuracy of reporting units, calculations, and interpretations

Where appropriate, field data forms and calculations will be processed and included as appendixes to the reports generated. Original field logs, documents, and data reductions will be kept in the project file.

### 1.8.2.2 Laboratory Data Reporting

Data reduction will be done manually or using appropriate application software. Quantitation procedures specified for each method must be followed. Calculations for analyses are based on regression analyses of calibration curves. Regression analysis is used to fit a curve through calibration standard data. Sample concentrations are calculated using the resulting regression equations. If data are reduced manually, the documentation must include the formulas used Any application software used for data reduction must have been previously verified by the laboratory for accuracy. Documentation of the software's verification must be maintained on file in the laboratory. All documentation of data reduction must allow re-creation of the calculations.

Whenever possible, analytical data will be transferred directly from the instrument to a computerized data system Raw data will be stored electronically and in hard copy format. Laboratory data entry will be sufficient to document the information used to arrive at reported values.

Electronic data storage will be used when possible. All electronic data shall be maintained in a manner that prevents inadvertent loss, corruption, and inappropriate alteration. Electronic data will be accessible and retrievable for a period of 10 years after project completion.

All data will undergo at least three levels of review at the laboratory before release. The analyst performing the tests initially will review 100 percent of the data. After the analyst's review has been completed, 100 percent of the data will be reviewed independently by a senior analyst or by the section supervisor for accuracy, compliance with calibration, and QC requirements, holding time compliance, and for completeness. Analyte identification and quantitation must be verified. Calibration and QC results will be compared with the applicable control limits Reporting limits should be reviewed to make sure they meet the project objectives. Results of multiple dilutions should be reviewed for consistency. Any discrepancies must be resolved and corrected. Laboratory qualifiers will be applied when there are nonconformances that could potentially affect data usability. These qualifiers must be properly defined as part of the deliverables. All issues relevant to the quality of the data must be addressed in a case narrative. The laboratory QC manager will review at least 10 percent of data or deliverables generated for this program against the project-specific requirements. A final data review will then be conducted by the laboratory QAM for review and approval. The laboratory QAM will review the package, ensure that necessary corrections are made, and forward it to the laboratory project manager for review. A copy of the data package will be filed in the project file. Mailed data packages, along with applicable electronic data deliverables (EDDs), will be sealed in an appropriate shipping container with a custody seal and logged on a document mailing log.

Deviations from stated guidelines must be addressed through corrective action. Deviations caused by factors outside the laboratory's control, such as matrix interference, will be noted with an explanation in the report narrative. The laboratory will contact the project chemist to discuss any deviations before the final data are sent out. Calculations will be checked and reports reviewed for errors, oversights, or omissions. The hard copy and electronic laboratory reports for all samples and analyses will contain the information necessary to perform data evaluation.

### 1.8.3 Electronic Analytical Record Format

The laboratory will provide EDDs for each batch or sample delivery group following Honeywell's required EDD specifications and guidance. These specifications are included in the Data Management Plan (DMP) and given to the laboratory in the laboratory contract or statement of work.

### 1.8.4 Project Record Maintenance and Storage

Project records will be stored and maintained in accordance with CH2M HILL's DMP and Subsection 2.9 of this QAPP. Each project team member is responsible for filing all project information or providing it to the project assistant familiar with the project filing system. Individual team members may maintain separate files or notebooks for individual tasks, but must provide such materials to the project file room upon completion of each task

The general project file categories are as follows:

- Correspondence
- Nonlaboratory project invoices and approvals by vendor
- Original unbound reports
- Nonlaboratory requests for proposals (solicitations), bids, contracts, and statements of work
- Field data
- Data evaluation and calculations
- Site reports from others
- Photographs .
- Insurance documentation .
- Laboratory analytical data and associated documents/memos
- Regulatory submittals, licensing, and permitting applications
- Site and reference material
- Health and safety plans
- Figures and drawings

A project-specific index of file contents must be kept with the project files at all times.

SECTION 2

# Data Generation and Acquisition

This section describes the procedures for acquiring, collecting, handling, measuring, and managing data in support of this sampling activity. It addresses the following data generation and acquisition aspects:

- Sampling process design
- Sample handling and custody requirements
- Sampling method requirements
- Laboratory analytical method requirements
- Laboratory QC requirements
- Field and laboratory instrument calibration and frequency
- Inspection and acceptance requirements for supplies and consumables
- Data acquisition requirements
- Data management
- Field and laboratory instrument and equipment testing, inspection, and maintenance requirements

## 2.1 Sampling Process Design

### 2.1.1 Soil Sampling Summary

The sampling locations best fulfill the project objectives stated in Step 2 of the DQO process. The sampling design consists of surface and shallow subsurface soil sampling. For more information on proposed sample locations and quantities, refer to Section 2 2 in the FSP. Table 3 of this QAPP summarizes the number of field and QC samples to be collected. Sampling will be performed according to the methods identified in Section 2.2.6 of the FSP.

**TABLE 3**
Soil Samples
*Honeywell Former Celotex Site, Chicago, Illinois*

| Parameter | Analytical Method | Field Samples | Field Duplicates | MS/MSD[a] Samples | Field Blank (FB)[b] | Equipment Blank (EB)[b] | Total Samples |
|---|---|---|---|---|---|---|---|
| PAHs | SW-846 8270C | 462 | 46 | 23 / 23 | 3 | 23 | 580 |

[a]MS/MSD – Individual sample numbers listed, not MS/MSD set
[b]FBs and EBs are aqueous matrices.

### 2.1.2 Sampling Method Requirements

Section 2 2.6 of the FSP describes the field sampling method and Section 2 6 describes the decontamination procedures. Before sampling at a property, reusable (nondedicated) sampling equipment will be scrubbed with an Alconox and potable water solution, rinsed with potable water and then with analyte-free water, and air dried. Equipment blanks (EBs) will be collected by passing laboratory de-ionized water over decontaminated sampling equipment The EBs will be analyzed for the same parameters as the field samples to assess the effectiveness of the decontamination procedures.

## 2.2 Sample Handling and Custody Requirements

### 2.2.1 Sample Handling and Preservation

Table 4 summarizes the sample preservation and holding requirements.

**TABLE 4**
Required Analytical Method, Sample Containers, Preservation, and Holding Times
*Honeywell Former Celotex Site, Chicago, Illinois*

| Analyses | Preparatory / Analytical Method | Sample Matrix[a] | Container[b] | Qty | Preservative[c] | Holding Time[d] |
|---|---|---|---|---|---|---|
| PAHs | SW-846 3510C/8270C | W | 1-L amber glass | 2 | Cool to 4°C | 7/40 days[e] |
| | SW-846 3550B/8270C | S | 8 ounce glass | 1 | Cool to 4°C | 14/40 days[f] |

Notes
Sample containers and volume requirements will be specified by the independent analytical laboratory performing the tests
[a] S = surface soil, subsurface soil; W = water
[b] All containers will be sealed with Teflon®-lined screw caps
[c] All samples will be stored promptly at 4°C in an insulated chest
[d] Holding times are from the time of sample collection
[e] 7 days to extraction for water, 40 days for analysis
[f] 14 days to extraction for soil, 40 days for analysis

Corrective action will be initiated when a target analyte that exceeds the reporting limit is detected in an equipment blank. Such actions may include discontinuing the use of a specific bottle lot, contacting the bottle suppliers for retesting the representative bottle from a suspect lot, resampling suspect samples, validating the data (accounting for contaminants possibly introduced by the laboratory as a bottle QC problem [e g., common laboratory solvents, sample handling artifacts]), and determining whether the bottles and data are usable

### 2.2.2 Sample Identification System

CH2M HILL has devised a sample numbering system that will be used to identify each sample, including duplicates and blanks. Detailed sample numbering information is located in Section 2.8 3, Sample Identification, of the FSP.

### 2.2.3 Sample Packaging and Shipment

Sample handling, packaging and shipping procedures are described in Section 2.8.8, Sample Handling, Packaging, and Shipping, of the FSP.

Sample coolers will be shipped to arrive at the laboratory the morning after sampling (priority overnight) or will be sent by a courier to arrive the same day. The laboratory will be notified of the sample shipment and the estimated date of arrival of the samples being delivered.

If samples are shipped, airbills will be retained to provide a record for sample shipment to the laboratory. Completed airbills will accompany shipped samples to the laboratory and forwarded along with data packages The airbill number will be documented on the COC form accompanying the samples to the laboratory for sample-tracking purposes. Airbills will be kept as part of the data packages in the project files.

### 2.2.4 Sample Custody

Accurate records, control of samples, and data custody are necessary to provide relevant and defensible data. Data custody is addressed during field sample collection, data analyses in the laboratory, and through proper handling of project files. Persons will be considered to have custody of samples when samples are in their physical possession, in their view after being in their possession, or in their physical possession and secured to prevent tampering. In addition, when samples are secured in a restricted area accessible only to authorized personnel, they will be deemed to be in the custody of such authorized personnel. Section 2.8 of the FSP further discusses sample custody in the field.

COC forms will provide the record of responsibility for sample collection, transport, and submittal to the laboratory. Field personnel designated as responsible for sample custody will fill out COC forms at each sampling site, at a group of sampling sites, or at the end of each day of sampling. Original COC forms will accompany samples to the laboratory, and copies will be forwarded to the project files. A sample COC is provided in Appendix B.

#### 2.2.4.1 Field Custody Procedures

COC forms will be required for all samples The sampling crew in the field will initiate COC forms. COC forms will contain the sample's unique ID, sample date and time, sample description, sample type, preservation (if any), and analyses required. Original COC forms, signed by the sampling crew, will accompany the samples to the laboratory. A copy of relinquished COC forms will be retained with the field documentation. COC forms will remain with the samples at all times Samples and signed COC forms will remain in the sampling crew's possession until samples are delivered to the express carrier (Federal Express), courier, hand-delivered to the laboratory, or placed in secure storage.

#### 2.2.4.2 Laboratory Custody Procedures

Laboratory custody procedures will be in place to ensure the integrity of sample and laboratory data handling Subcontracted laboratory custody procedures are defined in the laboratory's COC SOP in Appendix A

### 2.2.4.3 Laboratory Sample Receipt

Upon sample receipt, the laboratory sample custodian will open the coolers, check temperature blanks (and record temperatures), verify sample integrity, and inspect contents against the COC. The laboratory project manager will be contacted to resolve any discrepancies between sample containers and COC forms. Once the shipment and COC form are in agreement, the sample custodian will initiate an internal COC form as well as supply the laboratory task manager with a sample acknowledgement letter or e-mail. Verification of the cooler temperature and sample preservation will be performed and documented. If the cooler temperature is outside of criteria (4+/-2°C) upon receipt, or any other discrepancies are identified, the laboratory will contact the project chemist, who will determine the proper course of action.

Samples will be logged into the Laboratory Information Management System (LIMS), which assigns a unique laboratory number to each sample. LIMS will be used by all laboratory personnel handling samples, to ensure all sample information is captured. Analyses required will be specified by codes assigned to samples at log in. Labels containing the laboratory sample number are generated and placed on sample bottles.

### 2.2.4.4 Laboratory Sample Storage

After the laboratory labels the samples, they will be moved to refrigerators where they will be maintained at 4°C. Access to the laboratory is limited by either locked doors or front desk sign in.

When samples are required, laboratory staff will sign and date the appropriate internal COC forms. If entire samples are depleted during analysis, the notation "sample depleted" or "entire sample used" will be made on the internal COC forms.

Sample extracts will be stored in designated secure, refrigerated storage areas. Samples and sample extracts will be maintained in secure storage until disposal. No samples or extracts will be disposed of without prior written approval from an appropriate member of the project team. The sample custodian will note sample disposal date in the sample ledger The laboratory will dispose of samples in accordance with applicable regulations.

### 2.2.4.5 Laboratory Logbooks

Workbooks, bench sheets, instrument logbooks, and instrument printouts will be used to trace the history of samples through the analytical process and document important aspects of the work, including associated QC As such, all logbooks, bench sheets, instrument logs, and instrument printouts will be part of the laboratory's permanent record. Relevant information will be entered into the LIMS at the time information is generated.

Each page or entry will be dated and initialed by the analyst at the time of entry. Entry errors will be crossed out in indelible ink with a single stroke, corrected without obliterating or writing directly over the erroneous entry, and initialed and dated by the individual making the correction. Unused pages of logbooks will be completed by lining out unused portions that are then initialed.

The analyst will record information regarding the sample, the analytical procedures performed, and the results on laboratory forms and enter this information in LIMS. These notes will be dated and identify the analyst, instruments used, and instrument conditions.

Sufficient raw data records must be retained to permit reconstruction of initial instrument calibrations calibration date, test method, instrument, analysis date, each analyte name, concentrations and responses, calibration curves, response factors, or unique equations or coefficients used to reduce instrument responses into concentrations.

From time to time, the laboratory group leaders will review laboratory notebooks for accuracy, completeness, and compliance with this QAPP. The laboratory group leader will verify all entries and calculations If all entries on the pages are correct, the laboratory group leader will initial and date the pages. Corrective action will be taken for incorrect entries before the laboratory group leader signs.

#### 2.2.4.6 Laboratory Project File

Documentation will be placed in a single, secured project file, maintained by the laboratory project manager This file will consist of these components, all filed chronologically

- Agreements
- Correspondence
- Memorandums
- Notes and data

Reports (including QA reports) will be filed with correspondence. Analytical laboratory documentation and field data will be filed with notes and data. Filed materials may only be removed by authorized personnel on a temporary basis. The name of the person removing the file will be recorded Laboratories will retain project files and data packages for at least 7 years unless otherwise specified.

#### 2.2.4.7 Computer Tape and Hard Copy Storage

All electronic files will be maintained on CD-ROM or DVD (preferred media types), magnetic tape, or diskette for 10 years. Hard copy data packages (including chromatograms) will be maintained in files for 7 years. The computer tape and hard copy storage should include notation of instrument run files and calibration.

## 2.3 Analytical Method Requirements

Once the samples have been properly collected and documented, the soil samples will be submitted to the selected independent laboratory subcontracted by CH2M HILL for analysis. Samples will be analyzed in accordance with this QAPP and the specified USEPA method.

### 2.3.1 Target Analytes and Reporting Limits

Tables 5-A and 5-B specify the target analytes, the required reporting limit, and achievable laboratory detection limits by method and matrix. The project action limits are as stated in

Table 1, Step 1: "The USEPA has set a cleanup objective of background (which is equal to 5 parts per million (ppm) B(a)P EQ." The B(a)P EQ concentration is the sum of the concentrations of seven PAH compounds, after each concentration is multiplied by that compounds relative potency (as compared to benzo(a)pyrene), as shown in Table 5-C Compounds that are non-detect will be utilized in the calculation through use of half the method detection limit Estimated values (J qualified) will be used as the reported value. All samples must be analyzed undiluted or at the lowest possible dilution level. The laboratory will contact the project chemist when dilutions are required due to matrix interference. When a target analyte's concentration exceeds the calibration range, a dilution analysis will be performed to accurately determine the analyte's concentration. The laboratory will report the undiluted/lowest dilution performed and any diluted analyses that are required

**TABLE 5-A**
Water Analytes and Reporting Limits
*Honeywell Former Celotex Site, Chicago, Illinois*

| Parameter | CAS Number | Project Reporting Limit (µg/L) | Achievable Lab MDLs (µg/L) | Project Method |
|---|---|---|---|---|
| Benzo(a)anthracene | 56-55-3 | 10 | 1 | SW-846 3510C/8270C |
| Benzo(a)pyrene | 50-32-8 | 10 | 1 | SW-846 3510C/8270C |
| Benzo(b)fluoranthene | 205-99-2 | 10 | 1 | SW-846 3510C/8270C |
| Benzo(k)fluoranthene | 207-08-9 | 10 | 1 | SW-846 3510C/8270C |
| Chrysene | 218-01-9 | 10 | 1 | SW-846 3510C/8270C |
| Dibenz(a,h)anthracene | 53-70-3 | 10 | 1 | SW-846 3510C/8270C |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | 10 | 1 | SW-846 3510C/8270C |

µ/L = micrograms per liter
MDL = Method Detection Limit

**TABLE 5-B**
Soil Analytes and Reporting Limits
Honeywell Former Celotex Site, Chicago, Illinois

| Parameter | CAS Number | Project Reporting Limit (µg/kg) | Achievable Lab MDLs (µg/kg) | Project Method |
|---|---|---|---|---|
| Benzo(a)anthracene | 56-55-3 | 330 | 33 | SW-846 3550B/8270C |
| Benzo(a)pyrene | 50-32-8 | 90 | 33 | SW-846 3550B/8270C |
| Benzo(b)fluoranthene | 205-99-2 | 330 | 33 | SW-846 3550B/8270C |
| Benzo(k)fluoranthene | 207-08-9 | 330 | 33 | SW-846 3550B/8270C |
| Chrysene | 218-01-9 | 330 | 33 | SW-846 3550B/8270C |
| Dibenz(a,h)anthracene | 53-70-3 | 90 | 33 | SW-846 3550B/8270C |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | 330 | 33 | SW-846 3550B/8270C |

µg/kg = micrograms per kilogram
MDL = Method Detection Limit

**TABLE 5-C**
Individual PAH potency relative to Benzo(a)pyrene assuming equal concentrations
*Honeywell Former Celotex Site, Chicago, Illinois*

| Compound | Relative Potency |
|---|---|
| Benzo(a)anthracene | 0 1 |
| Benzo(a)pyrene | 1 |
| Benzo(b)fluoranthene | 0 1 |
| Benzo(k)fluoranthene | 0 01 |
| Chrysene | 0 001 |
| Dibenz(a,h)anthracene | 1 |
| Indeno(1,2,3-cd)pyrene | 0 1 |

### 2.3.2 Analytical Standard Operating Procedures

The laboratory uses analytical SOPs to ensure that the samples submitted are accurately and precisely analyzed. The laboratory will follow their analytical SOP or the USEPA method guidance when this QAPP does not specify QC criteria. If not otherwise stated within this QAPP, the QC criteria used during the analyses are those stated within the analytical SOPs (Appendix A).

## 2.4 Quality Control Requirements

The analytical laboratory shall have a QC program to assess the reliability and validity of the analyses being performed. The purpose and creation of QC samples is discussed and summarized below. Laboratory quality control checks indicate the state of control that prevailed at the time of sample analysis. Quality control checks that involve field samples, such as matrix, surrogate spikes, and field duplicates, also indicate the presence of matrix effects Field-originated blanks provide a way to monitor for potential contamination to which field samples are subjected. This QAPP specifies requirements for method blanks, laboratory control samples (LCSs), surrogate spikes, and MS/MSDs that laboratories participating in the data collection effort must follow.

A laboratory quality control batch is defined as a method blank, LCS, MS/MSD, or a sample duplicate, depending on the method and 20 or fewer environmental samples of similar matrix that are extracted or analyzed together. For gas chromatography/mass spectrometry (GC/MS) volatile analyses, a method blank, LCS, and MS/MSD must be analyzed in each 12-hour time period. The number of environmental samples allowed in the laboratory quality control batch is defined by the remaining time in the method-prescribed 12-hour time period divided by the analytical run time. Each preparation or analytical batch will be identified in such a way as to be able to associate environmental samples with the appropriate laboratory QC samples.

## 2.4.1 Quality Control Samples

### 2.4.1.1 Quality Control Analyses/Parameters Originated by the Laboratory

**Method Blank.** Blanks are used to monitor each preparation or analytical batch for interference and/or contamination from glassware, reagents, and other potential sources within the laboratory. A method blank is an analyte-free matrix (laboratory reagent water for aqueous samples or Ottawa sand, sodium sulfate, or glass beads (metals) for soil samples) to which all reagents are added in the same amount or proportions as are added to the samples. It is processed through the entire sample preparation and analytical procedures along with the samples in the batch. There will be at least one method blank per preparation or analytical batch. If a target analyte is found at a concentration that exceeds the reporting limit, corrective action must be performed to identify and eliminate the contamination source. All associated samples must be re-prepared and reanalyzed after the contamination source has been eliminated. No analytical data may be corrected for the concentration found in the blank.

**Laboratory Control Sample.** The LCS will consist of an analyte-free matrix such as laboratory reagent water for aqueous samples or Ottawa sand, sodium sulfate, or glass beads (metals) for soil samples spiked with known amounts of analytes that come from a source different than that used for calibration standards. Target analytes specified in the QAPP will be spiked into the LCS. The spike levels will be less than or equal to the mid-point of the calibration range. If LCS results are outside the specified control limits, corrective a ction must be taken, including sample re-preparation and reanalysis, if appropriate. If more than one LCS is analyzed in a preparation or analytical batch, the results of all LCSs must be reported. Any LCS recovery outside quality control limits affects the accuracy for the entire batch and requires corrective action.

**Matrix Spike/Matrix Spike Duplicate.** A sample matrix fortified with known quantities of specific compounds is called a matrix spike. It is subjected to the same preparation and analytical procedures as the native sample For this project, all target analytes specified in the QAPP will be spiked into the sample Matrix spike recoveries are used to evaluate the effect of the sample matrix on the recovery of the analytes of interest. An MSD is a second fortified sample matrix. The relative percent difference (RPD) between the results of the duplicate matrix spikes measures the precision of sample results. Only project-specific samples designated on the COC form will be spiked The spike levels will be less than or equal to the mid-point of the calibration range. MS/MSD pairs will be analyzed at a frequency of one pair for every 20 samples. The QA/QC precision and accuracy criteria are those stated in Table 6.

### 2.4.1.2 Quality Control Analyses Originated by the Field Team

Field QC samples will be collected to determine the accuracy and precision of the analytical results. The QC sample frequencies are stated below. Sampling activities will be conducted in accordance with the Health and Safety Plan and all sample-handling procedures will be in accordance with this QAPP. Table 4 summarizes sample containers, holding times, and preservation requirements.

Equipment Blank. EBs will be collected to monitor cleanliness of sampling equipment and the effectiveness of decontamination procedures. Contamination from the sampling equipment can cause high analytical results or lead to reporting false positive results. EBs will be prepared by filling sample containers with laboratory-grade analyte-free water that has been passed through a decontaminated or unused disposable sampling device. The required QC limits for EB concentrations are to be less than the method's reporting limit EBs will be collected at a frequency of one per twenty samples, at a minimum frequency of one per week. Samples associated with EBs that have detected target analytes will be assessed. The usability of the associated analytical data will be documented and affected data will be appropriately qualified.

**Field Duplicate.** Field duplicates are collected in the field from a single aliquot of sample to determine the precision and accuracy of the field team's sampling procedures. Field duplicates will be collected and analyzed at a frequency of one duplicate for every 10 samples. The precision criteria for the duplicate samples will be ± 35 percent in soil samples.

Laboratory QC requirements are provided in Table 6.

**TABLE 6**
Accuracy and Precision Limits for PAHs
*Honeywell Former Celotex Site, Chicago, Illinois*

| Analyte | LCS Accuracy Water (% R) | MS/MSD Accuracy Water (% R) | Precision Water (% RPD) | LCS Accuracy Sediment (% R) | MS/MSD Accuracy Sediment (% R) | Precision Sediment (% RPD) |
|---|---|---|---|---|---|---|
| Benzo(a)anthracene | 72-112 | 72-112 | 30 | 73-111 | 42-137 | 30 |
| Benzo(a)pyrene | 68-121 | 70-115 | 30 | 72-117 | 38-142 | 30 |
| Benzo(b)fluoranthene | 67-117 | 69-114 | 30 | 68-116 | 42-141 | 30 |
| Benzo(k)fluoranthene | 67-120 | 68-117 | 30 | 71-116 | 36-143 | 30 |
| Chrysene | 70-111 | 71-111 | 30 | 72-110 | 39-140 | 30 |
| Dibenzo(a,h)anthracene | 71-129 | 73-126 | 30 | 70-130 | 35-157 | 30 |
| Indeno(1,2,3-cd)pyrene | 67-122 | 69-118 | 30 | 66-123 | 32-146 | 30 |
| **Surrogates** | | | | | | |
| 2-Fluorobiphenyl | 64-112 | | | 55-123 | | |
| Nitrobenzene-d5 | 51-123 | | | 47-128 | | |
| Terphenyl-d14 | 52-151 | | | 51-158 | | |

LCS = Laboratory control sample
MS = Matrix spike
MSD = Matrix spike duplicate
R = Recovery
RPD = Relative percent difference

## 2.4.2 Data Precision, Accuracy, and Completeness

Field QA/QC samples and laboratory internal QA/QC samples are collected and analyzed to assess the data's usability Analytical SOPs and Table 6 specify acceptance criteria for precision and accuracy requirements for these QC samples. The QA/QC criteria for the internal laboratory QC samples that are not referenced in the appropriate analytical SOPs shall be those stated in the referenced methods. Completeness is the percentage of usable data obtained during the sampling event and its acceptance criteria is project specific

### 2.4.2.1 Precision

The precision of laboratory analysis will be assessed by comparing the analytical results between MS/MSDs. The precision of the field sampling procedures will be assessed by reviewing field duplicate sample results. The RPD will be calculated for the duplicate samples using the equation

$$\%RPD = \{(S - D)/[(S + D)/2]\} \times 100$$

where: S = First sample value (original value)
D = Second sample value (duplicate value)

The precision criteria for the duplicate samples will be ± 35 percent in soil samples Sample results will be qualified "J" as estimated in quantity when this QC limit is exceeded The acceptable MS/MSD precision criteria are stated in Table 6 if they are more stringent than the analytical SOPs.

### 2.4.2.2 Accuracy

Accuracy of laboratory results will be assessed for compliance with the established QC criteria using the analytical results of method blanks, reagent/preparation blanks, and MS/MSD samples. Laboratory results accuracy will be assessed for compliance with the established QC criteria described in the analytical SOPs The percent recovery (%R) of laboratory control samples will be calculated using the equation

$$\%R = (A/B) \times 100$$

where:

A = The analyte concentration determined experimentally from the laboratory control sample

B = The known amount of concentration in the sample

The accuracy criteria for the QA/QC samples are those stated in Table 6 if they are more stringent than the analytical SOPs.

### 2.4.2.3 Completeness

The data completeness of laboratory analyses results will be assessed for compliance with the amount of data required for decision making. Complete data are data that are not rejected. Data qualified with qualifiers such as a "J" or a "UJ" are still deemed acceptable

and can still be used for making project decisions. The completeness of the analytical data is calculated using the equation

$$\% \text{ Completeness} = [(\text{Valid data obtained})/(\text{Total data planned})] \times 100$$

The percent completeness goal for this sampling event is 90 percent.

#### 2.4.2.4 Representativeness

Representativeness is the degree to which sampling data accurately and precisely represent site conditions, and is dependent on sampling and analytical variability and the variability of environmental media at the site. Representativeness is a qualitative "measure" of data quality.

The goal of achieving representative data in the field starts with a properly designed and executed sampling program that carefully considers the project's overall DQOs. Proper location controls and sample handling are critical to obtaining representative samples.

The goal of achieving representative data in the laboratory is measured by assessing accuracy and precision. The laboratory will provide representative data when all of the analytical systems are in control. Therefore, representativeness is a redundant DQO for laboratory systems if proper analytical procedures are followed and holding times are met.

In addition, laboratories must demonstrate that the staff is qualified to perform the analyses, certified, and proficient in the analytical methods being employed

#### 2.4.2.5 Comparability

Comparability is the degree of confidence to which one data set can be compared to another. Comparability is a qualitative "measure" of data quality.

The goal of achieving comparable data in the field starts with a properly designed and executed sampling program that has the project's overall DQOs carefully integrated. Proper location controls and sample handling are critical to obtaining comparable samples.

The goal of achieving comparable data in the laboratory is measured by assessing accuracy and precision. The laboratory will provide comparable data when all of the analytical systems are in control. Therefore, comparability is a redundant DQO for laboratory systems if proper analytical procedures are followed and holding times are met

#### 2.4.2.6 Sensitivity

Sensitivity is the ability of the method or instrument to detect the contaminant of concern and other target compounds at the level of interest. Appropriate sampling and analytical methods will be selected (Tables 1 and 2) that have QC acceptance limits that support the achievement of established performance criteria (see Table 5 for Reporting Limit Objectives). Assessment of analytical sensitivity will require thorough data validation Soil samples do not require stabilization of any kind before sampling.

# 2.5 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

## 2.5.1 Field Instrument Maintenance

There will not be any field instruments used that requires maintenance.

## 2.5.2 Laboratory Equipment/Instruments

Only qualified personnel will service instruments and equipment. Repairs, adjustments, and calibrations will be documented in the appropriate logbook or data sheet.

### 2.5.2.1 Instrument Maintenance

Preventive maintenance of laboratory equipment will follow guidelines recommended by the manufacturer. A malfunctioning instrument will be repaired by in-house staff or through a service call to the manufacturer.

The laboratory will maintain a sufficient supply of spare parts for its instruments to minimize downtime. Whenever possible, backup instrumentation will be on hand.

Whenever practical, analytical equipment should be maintained under a service contract. Such contracts allow for preventative system maintenance and repair on an "as-needed" basis The laboratory should have sufficiently trained staff to allow for the day-to-day maintenance of equipment. All laboratory instruments will be maintained in accordance with manufacturer's specifications and within the requirements of the laboratory Quality Assurance Manual.

All maintenance must be documented in the logbooks

### 2.5.2.2 Equipment Monitoring

Operation of balances, ovens, refrigerators, and water purification systems will be checked daily and documented. Discrepancies will be reported immediately to the appropriate laboratory personnel for resolution.

Specific laboratory preventative maintenance procedures are found in the laboratory's internal laboratory Quality Assurance Manual.

# 2.6 Instrument Calibration and Frequency

## 2.6.1 Laboratory Instruments

Laboratory instruments will be calibrated by qualified personnel before sample analysis, according to the procedures specified in each method, analytical SOPs, and as noted below. Calibration will be verified at method-specified intervals throughout the analysis sequence. The frequency and acceptance criteria for calibration are specified for each analytical method, with supplemental requirements defined below for organic methodologies. When multi-point calibration is specified, the concentrations of the calibration standards should

bracket those expected in the samples. Samples will be diluted, if necessary, to bring analyte responses to within the calibration range. Data that exceed the calibration range cannot be reported by the laboratory. The initial calibration curve will be verified as accurate with a standard purchased or prepared from an independent second source. The initial calibration verification involves the analysis of a standard containing all the target analytes, typically in the middle of the calibration range, each time the initial calibration is performed. Quantitation based on extrapolation is not desirable Designated laboratory personnel performing QC activities will maintain and file records of calibration, repairs, or replacement. These records will be filed where the work is performed and subject to a QA audit.

Standards used in equipment must be traceable, directly or indirectly, to the National Institute of Standards and Technology. All standards received will be logged into standard receipt logs maintained by the individual analytical groups. Each group maintains a standards log that tracks the preparation of standards used for calibration and QC purposes.

#### 2.6.1.1 Initial Calibration Models for the Determination of Organic Compounds

Organic methodologies often provide multiple options for initial calibration curve fits and associated acceptance criteria for use. The following sections outline required "good laboratory practices" that will be employed by the laboratory The hierarchy that the laboratory will use when selecting the calibration curve fit for use in quantitation of sample results is outlined below.

#### Calibration Techniques

- Verify that correct instrument operating conditions and routine maintenance as specified in the method and laboratory SOPs are employed. Document all maintenance activities in a laboratory notebook for troubleshooting and scheduling of future routine, periodic maintenance.

- Ensure that the instrument is free of contamination prior to calibration. Do NOT perform any blank subtraction.

- Perform the entire initial calibration before sample analyses. The calibration standards must be analyzed in a sequential order from the lowest to highest concentration. If **one** calibration standard fails to meet criteria, it may be reanalyzed at the end of the calibration sequence. Justification for removing a calibration point from the curve fit selected includes such items as improper purge, injection failure, non-spiked level, or other obvious failures. The failure of multiple standards suggests an instrument problem or operator error and corrective action is required

- Determine calibration points. Only the lowest calibration point or the highest calibration point can be removed from the calibration curve without justification. If the lowest standard is removed, the reporting limit for that compound increases to the level of the next lowest calibration standard. Approval to elevate reporting limits greater than the project-specific objectives must be approved by the Project Chemist. If the highest standard is removed, the linear range is shortened for that compound.

- Ensure lowest standard in the calibration curve is at or below the required reporting limit.

- Ensure other standard concentrations define the working range of the instrument or the expected range of concentrations found in the samples
- Use internal calibration when a mass spectrometry detector is employed.
- Use a minimum of five calibration points for the calibration curve for GC/MS methods.
- Determine whether a linear or non-linear approach should be used based on calibration data. Most compounds tend to be linear, and a linear approach will be favored when linearity is suggested by the calibration data. Non-linear calibration will be considered only when a linear approach cannot be applied Before using a non-linear calibration approach, the Project Chemist must be notified and provide approval. It is not acceptable to use an alternate calibration procedure when a compound fails to perform in the usual manner. When this occurs, it is indicative of instrument problem or operator error.
- List analytes that exceed an RSD of greater than 20 percent in the case narrative. If the initial calibration of a given analyte exhibits a relative standard deviation (RSD) greater than 20 percent, but the average RSD for all analytes is less than 20 percent, a list of those analytes that exceeded the criteria will be provided in the laboratory report. For analyses conducted under this QAPP, compounds outside these criteria and the actual values of the RSD will be listed in the case narrative.

**2.6.1.2 Calibration Options** The following section outlines the acceptable calibration options and the hierarchy that the laboratory should use when selecting a specific option. The choice of calibration option may also be based on previous experience or a prior knowledge of detector response.

- **Linear calibration using average calibration or response factors.** Calibration factors for external calibrations or response factors for internal calibrations must have an RSD not exceeding 20 percent or 15 percent, respectively, to be used for quantitation. (For dioxins and furans by GC/MS, the maximum RSDs are 20 percent for unlabeled standards and 30 percent for labeled standards.) A minimum response factor of 0.05 for most target analytes and 0.01 for the least-responsive target analytes must be achieved to ensure detectability.
- **Linear calibration using a linear regression equation (y=mx+b).** The correlation coefficient must equal 0.995 or better. The line should NOT be forced through the origin The equation and a plot of the linear regression must be included in the raw data generated by the laboratory and made available in the data package upon Honeywell's request.

### 2.6.1.3 Continuing Calibration

Periodic verification of the initial calibration is essential in generating analytical data of known quality. The continuing calibration verification analyses ensure that the instrument has not been adversely affected by the sample matrix or other instrument failures that would increase or decrease the sensitivity or accuracy of the method. The laboratory will

**TABLE 7**
Calibration and QC Requirements for SW8270C
*Honeywell Former Celotex Site, Chicago, Illinois*

| QC Check | Frequency | Criteria | Corrective Action |
|---|---|---|---|
| DFTPP Tuning | Prior to initial calibration and calibration verification (every 12 hours) | Refer to criteria listed in the method | Retune instrument and verify |
| Multi-point initial calibration (minimum five points) | Prior to sample analysis, or when calibration verification fails | SPCCs average RF ≥ 0 050 and %RSD for RFs for CCCs ≤ 30% and one option below<br>Option 1 Mean %RSD for all analytes ≤ 15% with no individual analyte RSD > 30%, if using average RRFs | Correct the problem and repeat the initial calibration |
| Second-source calibration verification | Once for each multi-point initial calibration | All analytes within ±25% of expected value | Correct the problem and repeat initial calibration |
| Continuing calibration verification | At the start of each analytical sequence, after every 12 hours or 10 samples, whichever is more frequent, and at the end of the sequence | SPCCs average RF ≥ 0 050 and %D for RFs for CCCs ≤ 20%<br>All other analytes within ± 20% of expected value | Correct the problem, then recalibrate and reanalyze all samples since the last acceptable continuing calibration verification |
| Retention time window calculated for each analyte | Each analyte | Relative retention time of each analyte within ± 0 06 relative retention time units of the continuing calibration verification | Not applicable (used for identification of analyte) |
| Internal standards | Each sample and QC sample, method blank, MS/MSD and LCS | Retention time within ±30 seconds from retention time of the daily continuing calibration verification standard<br>EICP area within –50% to +100% of the daily continuing calibration verification standard | Inspect mass spectrometer and GC for malfunctions, reanalyze all affected samples |
| Method blank | At least one per analytical batch | No analytes detected at or above the reporting limit | Correct the problem, then re-prep and reanalyze all associated samples |
| Surrogate spike | Every standard, sample, method blank, MS/MSD, and LCS | Three surrogates in samples, method blank, and LCS within limits specified in accuracy and precision table | Correct the problem and reanalyze (re-prep if necessary) |
| MS/MSD | One set per 20 project-specific samples | Within limits specified in Accuracy and Precision table | None |
| LCS | At least one per analytical batch | Within limits specified in Accuracy and Precision table | Correct the problem, then re-prep and reanalyze the LCS and all samples in the analytical batch |

CCC = Calibration check compounds
DFTPP = Decafluorotriphenylphosphine
EICP = Extracted ion current profile
LCS = Laboratory control sample
MS = Matrix spike
MSD = Matrix spike duplicate
RF = Response factor
RRF = Relative response factor

perform continuing calibration for all methods according to the specific requirements in the method and laboratory SOPs.

Method SW8000B allows the use of the average of all analytes' percent-drift or recovery to meet the continuing calibration requirements for the method, but is NOT allowed by the Honeywell Program QAPP.

## 2.7 Inspection/Acceptance Requirements for Supplies and Consumables

It is expected that several contractors will provide various services under multiple project tasks The required services must meet the task scope, specified levels of quality, and the submittal schedule. Project contractors or vendors should have contractual arrangements with their material suppliers.

## 2.8 Nondirect Measurements

This subsection describes the identity of the types of data needed for project implementation and decision making not obtained from direct measurements.

The project objectives are first identified to assess the types of information needed to implement a project plan that meets the objectives stated in Section 1. Typically, the data needed to achieve project objectives include site maps, sampling location selection and sample identifiers, laboratory method selection and detection limit verification, analytical parameter lists and critical values, field measurement lists, and a project schedule. This information is included in this QAPP.

The sampling design and rationale of the sampling investigation activities were based upon previously collected data. Site maps and other site characterization data were used in the selection of sample locations.

## 2.9 Data Management Plan

The Data Management Plan (DMP) will be provided as a separate document Sections 2.9.1 to 2.9.8 provide a limited overview as additional detail is contained in the DMP. The DMP outlines the procedures for storing, handling, accessing, and securing data collected during this sampling event. Data gathered during this sampling event will be consolidated and compiled into a project database system that can be used to evaluate site conditions and data trends The DMP will serve as a guide for all database users The DMP is subject to future revisions to allow the database management system to be modified as it is developed and maintained The plan describes the following:

- The responsibilities of the project team for data management
- The Data Management System (DMS) to be established for the project
- The development of the base maps onto which the data will be plotted
- The types of data that will be entered into the DMS and the process of data entry

### 2.9.1 Team Organization and Responsibilities

The following are the team members and overview of their responsibilities for the data management process:

- **Site Manager and Project Chemist**—Establish the sample tracking system.
- **Project Chemist**—Tracks the COC forms and other sampling information Reviews laboratory data for accuracy and quality and compares electronic outputs for accuracy to laboratory hard copies. Reviews data outputs, such as result tables, before use in final documents and submission to client.
- **Database Manager**—Sets up DMS in consultation with the project chemist at the beginning of the data evaluation task. Oversees the data management process including data conversion/manual entry into DMS, QC of the entered data, and preparation of the required tables and plots of the data.

### 2.9.2 Sample Tracking

The project chemist is responsible for tracking samples to ensure that the analytical results for all samples sent for analysis are received. The project chemist also tracks receipt of laboratory deliverables.

### 2.9.3 Data Types

Activities performed at the site will involve accessing a number of different types of data collected or retained for various uses. The following provides a general description of the overall contents of the project database, as based upon the available data and the data to be collected

#### 2.9.3.1 Historical Data

Sources of historical data for the site include information collected by the previous contractors to characterize onsite and offsite conditions.

#### 2.9.3.2 Site Characterization Data

Data will be added to the project database as available. The data will include new data collected in the field and laboratory and reviewed by CH2M HILL The data source will be noted in the database. Procedures for incorporating the data into the database are presented in detail in the DMP

### 2.9.4 Data Tracking and Management

Every data set received from analytical laboratories will be tracked as discussed in Section 2.9.2 of this QAPP

#### 2.9.4.1 Electronic Data Deliverables

EDDs will be submitted from the laboratory in the specified format.

#### 2.9.4.2 Hard Copy

All raw analytical laboratory data are stored as the original hard copy. Hard copy information includes COC forms, analytical bench sheets, instrument printouts and chromatograms, certificates of analyses, and QA/QC report summaries.

#### 2.9.4.3 Data Input Procedures

Sampling information, analytical results, applicable QA/QC data, data validation qualifiers, and other field-related information will be entered into the project database for storage and retrieval during data evaluation and report development

### 2.9.5 LOCUS EIM Data Management System

The technical data, field observations, laboratory analytical results, and analytical data validation will be managed using Locus EIM®, a third-party database system to store and analyze project data submissions. The Locus EIM database system is based on a relational model, in which independent tables, each containing a certain type or entity of data, can be linked through selected fields that are common to two or more tables. This database design allows for the inclusion of historical data, and allows users to effectively conduct trend analysis and generate a variety of data reports to aid in data interpretation.

The Locus EIM DMS is protected from unauthorized access, tampering, accidental deletions or additions, and data or program loss that can result from power outages or hardware failure.

### 2.9.6 Documentation

Documentation of data management activities is critical because it provides the following:

- A hard copy record of project data management activities
- Reference information critical for database users
- Evidence that the activities have been properly planned, executed, and verified
- Continuity of data management operations when personnel changes occur

The DMP is the initial general documentation of the project data management efforts. Additional documentation will be maintained about specific issues, such as database structure definitions, database inventories, database maintenance, user requests, database issues and problems, and client contact.

### 2.9.7 Evidence File

The final evidence file will be the central repository for all documents that constitute evidence relevant to sampling and analysis activities. The CH2M HILL SM is the custodian of the evidence file and maintains the contents for the project, including relevant records, reports, logs, field notebooks, pictures, contractor reports, and data reviews in a secured area with limited access.

CH2M HILL will keep all records until project completion and closeout. As necessary, records may be transferred to an offsite records storage facility. The records storage facility

must provide secure, controlled-access records storage. Records of raw analytical laboratory data, QA data, and reports will be kept by the subcontract laboratory for at least 7 years.

### 2.9.8 Presentation of Site Characterization Data

Depending on the data user needs, data presentation may consist of any of the following formats:

- Tabulated results of data summaries or raw data
- Figures showing concentration isopleths or location-specific concentrations
- Tables providing statistical evaluation or calculation results

Other data may also be collected during field efforts, such as soil types. This information will be stored in the project database. Other types of data elements may be added as the field investigation needs and activities evolve.

SECTION 3

# Assessment and Oversight

## 3.1 Assessments and Response Actions

Field and laboratory assessments will be performed to assess technical and procedural compliance with this QAPP Performance and system audits are key to ensuring this compliance. The audits are conducted for the following purposes:

- Confirm that appropriate documents are properly completed and kept current and orderly
- Ensure measurement systems are accurate.
- Identify nonconformance or deficiencies and to initiate necessary corrective actions
- Verify that field and laboratory QA procedures called for in this QAPP are properly followed and executed.

The project chemist and the laboratory QAM are responsible for ensuring conformance with this QAPP and internal laboratory analytical SOPs (Appendix A). The SM and FTL are responsible for ensuring conformance with the FSP. Activities selected for audit will be evaluated against specified requirements, and the audit will include an evaluation of the method, procedures, and instructions Documents and records will be examined as necessary to evaluate whether the QA program is effective and properly implemented Reports and recommendations must be prepared on all audits and submitted to the QAM for retention in the project files.

### 3.1.1 Field Audits

#### 3.1.1.1 Field Audit Procedures

Planning, scheduling, and conducting QA audits and surveillance are required to verify that site activities are being performed efficiently in conformance with approved plans, standards, federal and state regulatory requirements, sound scientific practices, and contractual requirements. Planned and scheduled audits may be performed to verify compliance with aspects of the QA program and to evaluate the effectiveness of the QA program. Audits include the following:

- Objective examination of work areas, activities, and processes
- Review of documents and records
- Interviews with project personnel
- Review of plans and standards

The FTL will conduct regular internal reviews of the sampling program during the investigation and pay particular attention to the sampling program with respect to

representativeness, comparability, and completeness of the specific measurement parameters involved

The FTL or a designee will review field documentation (COC forms, field daily sheets, and logbooks) as it is generated for accuracy, completeness, and compliance with FSP and QAPP requirements. The FTL will also periodically audit field sampling procedures for compliance with QAPP procedures The auditor will check that the following are performed:

- Sampling protocols are followed.
- Samples are placed in proper containers.
- Samples are stored and transported properly.
- Field documentation is completed.

The USEPA holds the right to perform field audits during sampling activities

#### 3.1.1.2 Field Corrective Action

Any project team member may initiate a field corrective action process. The process consists of identifying a problem, acting to eliminate it, monitoring the effectiveness of the corrective action, verifying that the problem has been eliminated, and documenting the corrective action.

Corrective actions include correcting COC forms, problems associated with sample collection, packaging, shipping, field record keeping, or acquiring additional training in sampling and analysis Additional approaches may include re-sampling or evaluating and amending sampling procedures The FTL will summarize the problem, establish possible causes, and designate the person responsible for a corrective action. The FTL will then verify that the initial action has been taken and appears effective and follow up to verify that the problem has been resolved.

Technical staff and project personnel will be responsible for reporting suspected technical or QA nonconformances or suspected deficiencies by reporting the situation to the FTL The FTL will be responsible for assessing suspected problems in consultation with the QAM and the SM, and make a decision based on the situation's potential to impact data quality. If it is determined that the situation warrants a reportable nonconformance requiring corrective action, the FTL will initiate a nonconformance report.

The FTL will be responsible for ensuring that corrective actions for nonconformances are initiated by:

- Evaluating all reported nonconformances
- Controlling additional work on nonconforming items
- Determining disposition or action to be taken
- Maintaining a log of nonconformances
- Reviewing nonconformance reports and corrective actions taken
- Ensuring that nonconformance reports are included in the final documentation in the project files

## 3.1.2 Laboratory Audits

### 3.1.2.1 Laboratory Audit Procedures

The laboratory QAM may conduct internal system audits, which are qualitative evaluations of all components of the laboratory QC measurement system. The audit serves to determine if all measurement systems are used appropriately The system audits are conducted to evaluate the following:

- Sample handling procedures
- Calibration procedures
- Analytical procedures
- QC results
- Safety procedures
- Record keeping procedures
- Timeliness of analysis and reporting

Laboratories also are subject to external audits, which focus on assessing general laboratory practices and conformance to this QAPP. Laboratory audits may be performed before the start of analyses and at any time during the course of the project as deemed necessary.

The laboratory QAM will review internal laboratory performance The laboratory QAM will evaluate laboratory precision and accuracy by comparing results of duplicate samples, QC samples, spikes, and blanks. The laboratory QAM or other client services individual will check the analytical data prior to distribution when a "beyond-control-limit" situation is encountered.

External laboratory performance reviews may be conducted based on evaluation of the results of check samples analyzed as part of USEPA or state certification requirements. Performance audits may be conducted by sending "double blind" performance evaluation samples to the analytical laboratory (those not discernable from routine field samples).

### 3.1.2.2 Laboratory Corrective Action

Corrective actions may be required for two classes of problems: analytical/equipment problems and noncompliance problems. Analytical/equipment problems may occur during sampling, sample handling, sample preparation, laboratory instrumental analysis, or data review.

A corrective action program will be determined and implemented when a noncompliance problem is identified The person identifying the problem will be responsible for notifying the proper project member. If the problem is analytical in nature, information on the problem will be communicated to the laboratory QAM and the project chemist, who will in turn direct information to proper project members.

Corrective actions are required whenever an actual or potential "out-of-control" event is noted The specific investigative action taken will depend on the analysis and the event in question. Laboratory personnel are alerted that corrective action may be necessary if any of the following occur

- QC data are outside the warning or acceptable windows for precision and accuracy.

- Blanks contain target analytes above acceptable levels
- Undesirable trends are detected in spike recoveries or relative percent difference between duplicates.
- Unusual changes in detection limits occur.
- Inquiries concerning data quality are received.
- Deficiencies are detected by the laboratory QAM during internal or external audits or from results of performance evaluation samples.

Corrective action procedures in the laboratory are often handled at the bench level by the analyst who reviews preparation or extraction procedures for possible errors, checks instrument calibrations, spike and calibration mixes, and instrument sensitivity. If problems persist or cannot be identified, matters are referred to the laboratory supervisor, laboratory project manager, or laboratory QAM for further investigation. The laboratory project manager is to contact CH2M HILL's project chemist to discuss any corrective action needed. Once resolved, full documentation of the corrective action procedures is filed with the Laboratory QAM after approval by the SM or the project chemist. Corrective action may include the following:

- Resampling and analyzing
- Evaluating and amending sampling procedures
- Evaluating and amending analytical procedures
- Accepting data and acknowledging the level of uncertainty
- Reanalyzing the samples, if sample or extract volume is adequate and holding time criteria permit

If resampling is deemed necessary because of laboratory problems, the project chemist and the SM together must identify the appropriate course of action to be taken, including potential cost recovery from the laboratory for the additional sampling effort.

## 3.2 Reports to Management

In addition to the audit reports that may be submitted to the SM in accordance with this QAPP, the SM prepares a progress report that addresses QA issues and corrective actions proposed or already taken. After sample results have been received from the laboratory and evaluated, reduced, and tabulated, a data evaluation report will be submitted to the Program Manager that documents the field investigation.

SECTION 4

# Data Validation and Usability

## 4.1 Data Review, Verification, and Validation

### 4.1.1 Data Validation Process

Data validation is the process by which data generated in support of a project are reviewed against the data QA/QC requirements The data are evaluated for precision and accuracy against the analytical protocol requirements Nonconformance or deficiencies that could affect the precision or accuracy of the reported result are identified and noted. The effect on the result is then considered when assessing whether the result is sufficient to achieve DQOs.

Deficiencies discovered as a result of data validation, as well as corrective actions implemented in response, will be documented and submitted in the form of a written report with supporting documentation supplied as check sheets. Data validation will be patterned after the USEPA *Contract Laboratory National Functional Guidelines for Organic Data Review* (1999). The flagging criteria in Table 8 will be used as guidance. The qualifier flags are defined in Table 9.

The analytical results of the data collection effort will be validated by CH2M HILL. Four levels of validation correspond to the reports described in Section 1.8.2. Levels 1 and 2 may be performed by the project chemist or other program team members. Levels 3 and 4 validation will always be performed by the project chemist or his/her designee. For this project, only Level 3 and Level 4 validation will be performed.

| | |
|---|---|
| Level 1 | Verification that samples were analyzed for the methods requested and review of the data for outliers and anomalies. |
| Level 2 | Verification that samples were analyzed for the methods requested, review of the laboratory case narrative for events in the laboratory that affect the accuracy or precision of the data, review of quality control indicator data, and a "reasonableness" review of the data. |
| Level 3 | Validation of the analytical data as described below without review of any raw data or analyte verification |
| Level 4 | Validation of the analytical data will be performed as described below, including review of the analytical raw data. |

### 4.1.2 Levels 3 and 4 Validation Procedures

Personnel involved in data validation will be independent of any data generation effort. The project chemist will be responsible for oversight of data validation. Data validation will be carried out when the data packages are received from the laboratory. It will be performed on an analytical batch basis using the summary results of calibration and laboratory quality

control, as well as those of the associated field samples. For this project, Level 3 data validation will be performed on 100 percent of the data packages. An additional Level 4 validation (review of the raw data) will be performed on approximately 50 percent of the data packages. Validation will be performed using the following procedures and those referenced for Level 3 or 4, as appropriate:

- A review of the data set narrative to identify any issues that the lab reported in the data deliverable
- A check of sample integrity (sample collection, preservation, and holding times)
- An evaluation of basic QC measurements used to assess the accuracy, precision, and representativeness of data, including QC blanks, LCSs, matrix spikes/matrix spike duplicates (MS/MSD), surrogate recovery when applicable, and field or laboratory duplicate results
- A review of sample results, target compound lists, and detection limits to verify that project analytical requirements are met
- Initiation of corrective actions, as necessary, based on the data review findings
- Qualification of the data using appropriate qualifier flags, as necessary, to reflect data usability limitations

Level 3 validation procedures will also include reviewing the evaluation of calibration and quality control summary results against the project requirements and other method-specific QC requirements.

Level 4 validations will include reviewing sample chromatograms and verification of analyte identification and calculations for at least 50 percent of the data.

Qualifier flags, if required, will be applied to the electronic sample results. If multiple flags are required for a result, the most severe flag will be applied to the electronic result. The hierarchy of flags from the most severe to the least severe will be as follows: R, UJ, U, and J.

Any significant data quality problems will be brought to the attention of the project chemist.

**TABLE 8**
Flagging Conventions for PAHs
*Honeywell Former Celotex Site, Chicago, Illinois*

| Quality Control Check | Evaluation | Flag | Samples Affected |
|---|---|---|---|
| **Holding Time** | **Holding time exceeded for extraction or analysis** | J positive results | Affected samples |
| | **By a factor of two** | R non-detects | |
| ***Temperature*** | *Temperature exceedance >10°C if received within 24 hours)* | *UJ non-detects* | |
| | Temperature exceedance >6°C if received > 24 hours) | UJ non-detects, J positive results | |
| **Sample preservation** | **Sample preservation requirements not met** | J positive results | Affected samples |
| | If preservation is not performed in the field, but performed in the laboratory upon receipt, no flagging is required | R non-detects | |
| **Sample Integrity** | Professional judgment on sample condition | J positive results/professional judgment | Affected samples |
| | Example: Bubbles in VOA vial used for analysis | R non-detects/professional judgment | |
| **GC/MS Instrument Performance Check** | **Mass assignment in error and laboratory cannot reprocess data** | R all results | All samples in batch |
| | **Ion abundance criteria not met** | R all results if critical ions involved, use judgment otherwise | All samples in batch |
| **Initial Calibration GC/MS Methods** | **RRF <0.050** | J positive results | Analyte in associated samples |
| | | UJ non-detects | |
| | **%RSD > 30% and no calibration curve used or linear calibration curve used and R < 0.990** | J positive results | Analyte in associated samples |
| | | UJ non-detects | |

**TABLE 8**
Flagging Conventions for PAHs
*Honeywell Former Celotex Site, Chicago, Illinois*

| Quality Control Check | Evaluation | Flag | Samples Affected |
|---|---|---|---|
| **Continuing Calibration Verification (CCV)** | **RRF <0.050** | J positive results, UJ non-detects | Analyte in associated samples |
| **GC/MS Methods** | RRF <0.010 | J positive results, UJ non-detects | Analyte in associated samples |
| (Second source and CCV) | **% difference or % drift >25% with high recovery** | J positive results | Analyte in associated samples |
| | | No flag applied to non-detects | Analyte in associated samples |
| | **% difference or % drift >25% with low recovery** | J positive results | Analyte in associated samples |
| | | UJ non-detects | |
| **Laboratory Control Sample (LCS)** | **%R >UCL** | J positive results | Analyte in associated samples |
| | | No flag applied to non-detects | |
| | **%R <LCL but ≥10%** | J positive results | Analyte in associated samples |
| | | UJ non-detects | |
| | **%R <LCL but ≤10%** | J positive results | Analyte in associated samples |
| | | R non-detects | |
| **Method Blank** (MB) <RL | **Convert blank to soil units if necessary, multiply highest blank value by 5** | U positive results < 5 x highest blank concentration | All associated samples in batch |
| **Equipment Blank** (Field Blank (FB)) <RL | **Convert blank to soil units if necessary, multiply highest blank value by 5** | U positive results < 5 x highest blank concentration | All associated samples in batch |

TABLE 8
Flagging Conventions for PAHs
*Honeywell Former Celotex Site, Chicago, Illinois*

| Quality Control Check | Evaluation | Flag | Samples Affected |
|---|---|---|---|
| **Matrix Spike/Matrix Spike Duplicates (MS/MSD)** does not apply if sample result is greater than four times the spike value | **%R >UCL** | J positive results<br>No flag applied to non-detects | Parent sample |
| | **%R <LCL but ≥10%** | J positive results<br>UJ non-detects | Parent sample |
| | **%R <LCL but ≤10%** | J positive results<br>R non-detects | Parent sample |
| | **RPD >UCL** | J positive results<br>No flag applied to non-detects | Parent sample |
| **Surrogates - SW8270** | **Two or more surrogates with %R >UCL** | J positive results<br>No flag applied to non-detects | Parent sample |
| | **Two or more surrogates with %R <LCL but ≥10%** | J positive results<br>UJ non-detects | Parent sample |
| | **Two or more surrogates with %R <LCL but ≤10%** | J positive results<br>R non-detects | Parent sample |
| **Internal Standards** -50% to +100% recovery | **Area > UCL** | J positive results<br>UJ non-detects | Associated analytes in sample |
| | **Area < LCL** | J positive results<br>UJ non-detects | Associated analytes in sample |

**TABLE 8**
Flagging Conventions for PAHs
*Honeywell Former Celotex Site, Chicago, Illinois*

| Quality Control Check | Evaluation | Flag | Samples Affected |
|---|---|---|---|
| | **Area < 10%** | J positive results<br>R non-detects | |
| **Field Duplicates**<br>± 50% precision for soil<br>± 30% precision for aqueous | **Both sample results >5 times RL and RPD>UCL** | J positive results | Field duplicate pair |
| | **One or both samples <5 times RL and a difference between results of ± 2 times RL for water and ± 3.5 times RL for soil** | J positive results<br>UJ non detects | Field duplicate pair |

C = Celsius
CCV = Calibration check verification
GC/MS = Gas chromatograph / mass spectrometer
LCL = Lower control limit
R = Recovery
RL = Reporting limits
RPD = Relative percent difference
RRF = Relative response factor
RSD = Relative standard deviation
UCL = Upper control limit
VOA = Volatile organic analysis

**TABLE 9**
Qualifier Flag Definitions
*Honeywell Former Celotex Site, Chicago, Illinois*

| Flag | Definition |
|---|---|
| J | Analyte was present but reported value may not be accurate or precise. |
| R | This result has been rejected |
| U | This analyte was analyzed for but not detected at the specified detection limit |
| UJ | The analyte was not detected above the detection limit objective However, the reported detection limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample |

## 4.2 Validation and Verification Methods

The data validation process is conducted to assess the effect of the overall sampling and analysis process on the usability of the data There are two areas of review: laboratory performance evaluation and the effect of matrix and sampling interference. The laboratory performance evaluation is a check for compliance with the method requirements and a straightforward examination. The laboratory either did or did not analyze the samples within the QC limits of the analytical method and according to protocol requirements. The assessment of potential matrix and sampling affects consists of a QC evaluation of the analytical results; the results of blank, duplicate, and matrix spike samples; and then assessing how, if at all, this could affect the usability of the data.

All analytical data will be supported by a data package. The data package will contain the supporting QC data for the associated field samples (see Section 1.8.2 of this QAPP for the data package content requirements). Before the laboratory will release each data package, the laboratory QAM (or the analytical section supervisor) must carefully review the sample and laboratory performance QC data to verify sample identity, the completeness and accuracy of the sample and QC data, and compliance with method specifications.

CH2M HILL will perform data validation for all sub-contracted laboratory generated data for samples also in a manner consistent with the *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (USEPA 1999) and Table 8. Sample results will then be assigned a degree of usability based upon overall data quality.

The CH2M HILL project team will evaluate the data validation results. This evaluation will assess how the data, as qualified by the data validation, can be used on the project.

The data, after validation, will also be verified to assess if the correct samples were analyzed and the correct parameters were reported The data are also verified to assess if the EDDs and the hard copy data deliverables are consistent with one another to ensure an accurate database. Also, the data will be evaluated to determine whether the results make sense in comparison to that anticipated If the data is consistent with anticipated results, no corrective action will be deemed necessary However, if the data obtained from the laboratory are not consistent with the anticipated results, an in-depth evaluation of the results may be necessary to interpret the deviation

## 4.3 Reconciliation with Data Quality Objectives

The final activity of the data validation process is to assess whether the data fulfilled the planned objectives for the project. The final results, as adjusted for the findings of any data validation/data evaluation, will be checked against the DQOs. The data acquired from the additional site investigation should fulfill the project objective to fill in any data gaps left from the previous site investigation and aid in determining the most appropriate remediation method

The data collected from the sampling investigation will be evaluated to assess if the project objectives have been met. The objectives will be met if all scheduled samples and data readings documented in this QAPP are obtainable, and all the data are deemed usable after validation and evaluation. If the objectives are not met, data collection will be required and implemented accordingly If the data, after validation and evaluation, are sufficient to achieve project objectives, the QAM and SM will release the data and work may proceed

SECTION 5

# References

CH2M HILL 2006 *Residential Soil Sampling Work Plan for the Residential Study Area Near the Former Celotex Site* April.

USEPA. 2000 *Region 5 – Instructions on the Preparation of a Superfund Division Quality Assurance Project Plan.* Based on EPA QA/R-5.

USEPA 1999 *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* EPA-540/R-99-008 (PB99-963506)

USEPA 1996. *Test Methods for Evaluating Solid Waste, Physical and Chemical Methods, SW-846, 3rd Edition, Update IIIB.*

# Appendix A
# Analytical Standard Operating Procedures

# Appendix B
# Chain-of-Custody

# Honeywell Chain Of Custody / Analysis Request

AESI Ref. 38449.41045
COC #.
Lab Use Only
Lab Proj #
Lab ID
PAGE 1 of
Job No

Privileged & Confidential
EDD To:
Site Name:
Location of Site:
Sampler:
P O #
Analysis Turnaround Time
Standard -
Rush Charges Authorized for -
2 weeks -
1 week -
Next Day -

Client Contact (name, co., address)

Hardcopy Report To:
Invoice To:

What is in the Text File?
Mouse over here

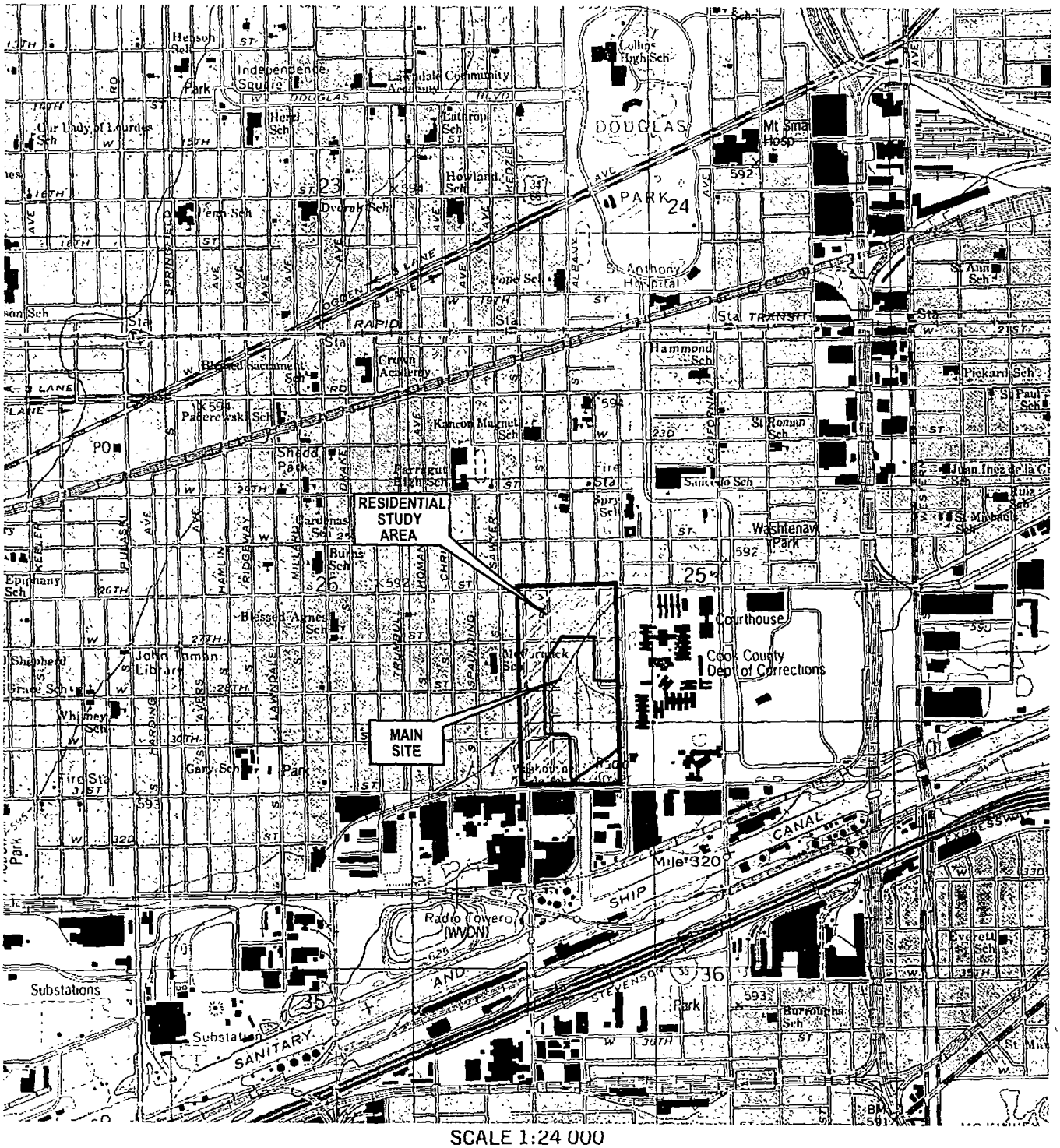
Written and maintained by AESI (Ver 3_7) 02-01-05
renesurgi@aol.com

| Sample Identification | | | | Sample Date | Sample Time | Sample Type | Sample Matrix | Sample Purpose | # of Cont | Grab/Composite | Field Filtered Sample ? | Preservative | Lab Sample Numbers |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location ID | Start Depth (ft) | End Depth (ft) | Field Sample ID | | | | | | | Units | | | |
| 1 | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Relinquished by | Company | | Received by | Company | | Condition | Custody Seals Intact |
| | Date/Time | | | Date/Time | | Cooler Temp | |
| Relinquished by | Company | | Received by | Company | | Condition | Custody Seals Intact |
| | Date/Time | | | Date/Time | | Cooler Temp | |

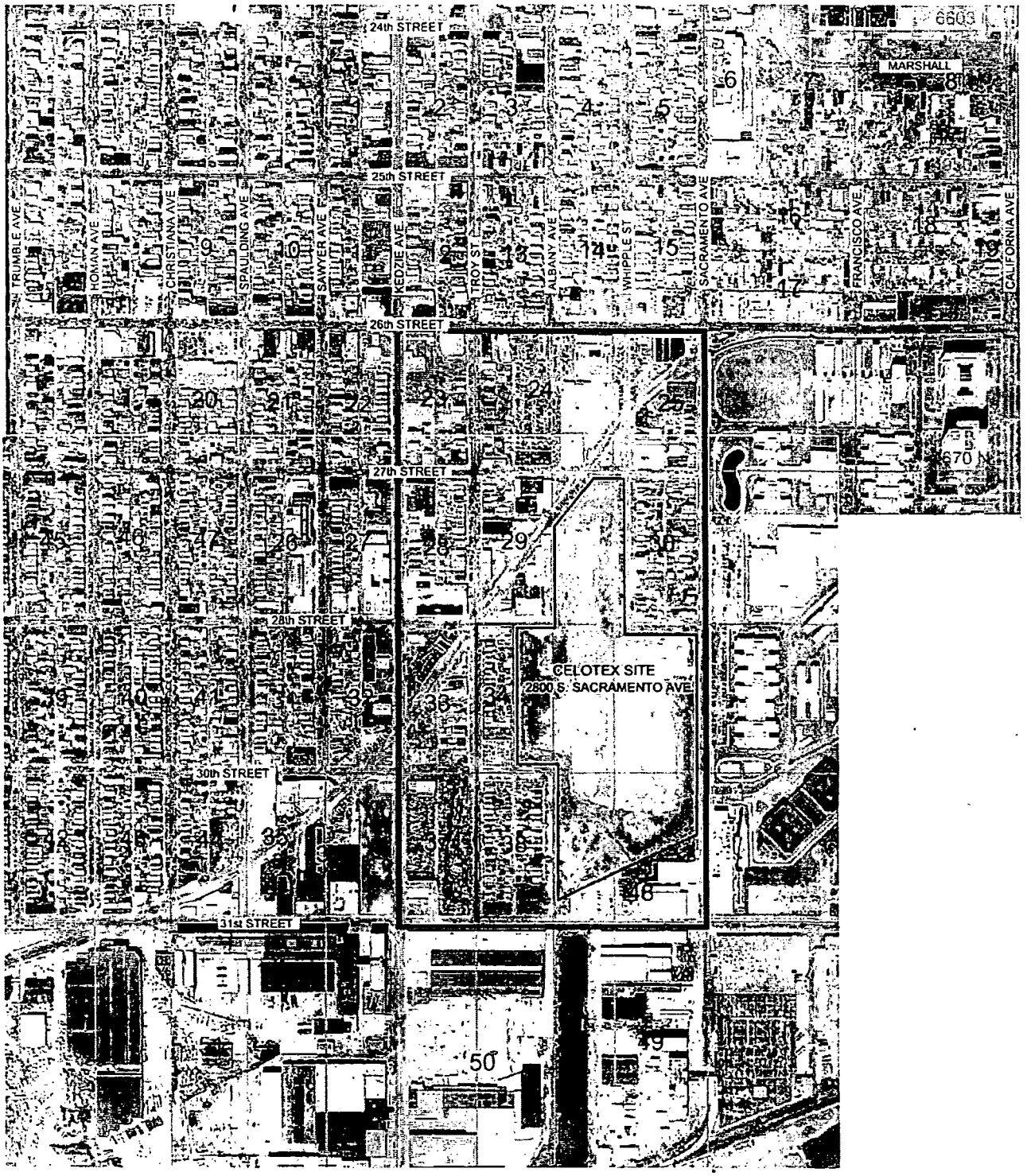
Preservatives 0 = None; [1 = HCL]; [2 = HNO3], [3 = H2SO4]; [4 = NaOH]; [5 = Zn. Acetate]; [6 = MeOH]; [7 = NaHSO4], 8 = Other (specify):

# Appendix C
# Site Location Map and Aerial Photograph




Source U S G S 7 5-Minute Quadrangle for Englewood, Illinois, 1997

Figure 1-1
**Site Location and Study Area**
**Residential Soil Sampling Work Plan**
**Former Celotex Site**
*Chicago, Illinois*




LEGEND

| | |
|---|---|
| 27 | Block Number |
| ———— | Northing and Easting Lines |
| ———— | Main Site |
| - - | Northeast Residential Area |
| ———— | Southwest Residential Area |
| ▬▬▬ | Residential Sampling Area |

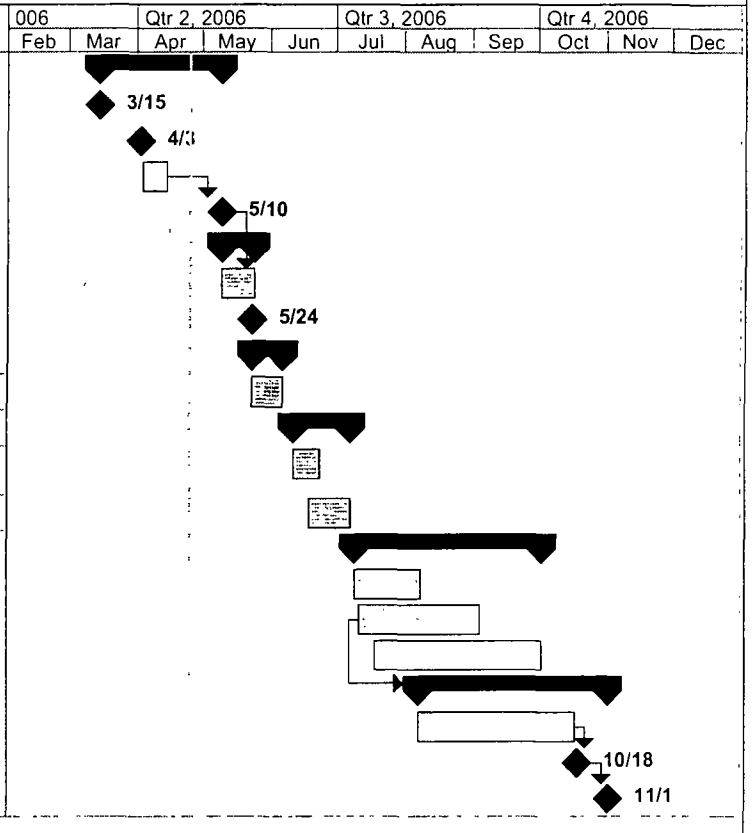
NOTE Soil sampling within the Northeast and Southwest Residential Areas is required by USEPA. Honeywell has voluntarily agreed to perform residential soil sampling within the larger area identified as the Residential Study Area

Figure 1-2
**Aerial Photograph**
**Residential Soil Sampling Work Plan**
**Former Celotex Site**
*Chicago, Illinois*

# Appendix D
# Project Schedule

**Figure 5-1**
**Proposed Project Schedule**
**Residential Soil Sampling Work Plan**
**Former Celotex Site**
**Chicago, Illinois**

| ID | Task Name | Duration | Start | Finish |
|---|---|---|---|---|
| 1 | **Prepare Residential Soil Sampling Work Plan** | **40 days** | **Wed 3/15/06** | **Wed 5/10/06** |
| 2 | Submit Draft Work Plan to USEPA | 0 days | Wed 3/15/06 | Wed 3/15/06 |
| 3 | Receive USEPA Comments | 0 days | Mon 4/3/06 | Mon 4/3/06 |
| 4 | Revise Work Plan for Community Distribution | 9 days | Tue 4/4/06 | Fri 4/14/06 |
| 5 | Receive Community Responses | 0 days | Wed 5/10/06 | Wed 5/10/06 |
| 6 | **Finalize Residential Soil Sampling Work Plan** | **11 days** | **Wed 5/10/06** | **Wed 5/24/06** |
| 7 | Submit Final Work Plan to USEPA | 11 days | Wed 5/10/06 | Wed 5/24/06 |
| 8 | Obtain USEPA Approval | 0 days | Wed 5/24/06 | Wed 5/24/06 |
| 9 | **Conduct Door-to-Door Visits (155 Properties)** | **10 days** | **Wed 5/24/06** | **Tue 6/6/06** |
| 10 | Explain Sampling Process, Establish Access Agreements | 10 days | Wed 5/24/06 | Tue 6/6/06 |
| 11 | **Complete Pre-Sampling Inspection and Utility Locate** | **20 days** | **Mon 6/12/06** | **Fri 7/7/06** |
| 12 | Document Current Property Conditions and Layout Sample Locations | 10 days | Mon 6/12/06 | Fri 6/23/06 |
| 13 | Perform Utility Clearance | 15 days | Mon 6/19/06 | Fri 7/7/06 |
| 14 | **Perform Sampling and Analysis** | **61 days** | **Mon 7/10/06** | **Mon 10/2/06** |
| 15 | Collect Soil Samples | 22 days | Mon 7/10/06 | Tue 8/8/06 |
| 16 | Analyze Soil Samples (666 composite samples) | 39 days | Wed 7/12/06 | Mon 9/4/06 |
| 17 | Data Validation/Evaluation (PAHs) | 54 days | Wed 7/19/06 | Mon 10/2/06 |
| 18 | **Prepare Residential Sampling Report** | **62 days** | **Tue 8/8/06** | **Wed 11/1/06** |
| 19 | Develop Residential Sampling Report | 51 days | Tue 8/8/06 | Tue 10/17/06 |
| 20 | Submit Residential Sampling Report to USEPA | 0 days | Wed 10/18/06 | Wed 10/18/06 |
| 21 | Receive USEPA Comments/Approval | 0 days | Wed 11/1/06 | Wed 11/1/06 |




Project Celotex_Schedule_042506 mpp
Date Tue 4/25/06

Task
Split
Progress
Milestone
Summary
Project Summary
External Tasks
External Milestone
Deadline